Remarks

The various parts of the Office Action (and other matters, if any) are discussed below under appropriate headings.

Claim Rejections - 35 USC § 102

Claims 1-3 and 6-18 have been rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 6,145,387 to Garshelis. The claims define patentable subject matter since the claimed feature of "a pair of opposite permanent magnet poles" that "induce a localized magnetic field in the magnetostrictive material ... during torque sensing" is not taught or reasonably suggested by Garshelis. The claimed permanent magnet poles form operable components of the claimed assemblies.

In contrast to the structure of the claimed assemblies, the magnets shown in figure 3 of Garshelis are used to permanently magnetize Garshelis' shaft and do not form an operable part of Garshelis' final sensor assembly. Rather, Garshelis' sensor assembly is formed from a permanently magnetized shaft and a field sensor.

With reference to claim 1, the claimed subject matter is a torque sensor comprising a magnetostrictive shaft, a pair of tangentially arranged permanent magnet poles that excite a localized magnetic field in the shaft during torque sensing and a flux detector that detects changes in the localized magnetic field that occur when the shaft is torqued. As explained in the specification, (see, for example, page 8, lines 3-10 and page 15, lines 6-7), the claimed magnetic poles form a component of the claimed sensor that induce an *in situ* magnetic field of the shaft.

The claim arrangement is in contrast to the conventional torque sensors described on pages 1 and 2 of the specification, which include the general sensor arrangement of Garshelis. In such sensors, only a shaft having permanent magnetic polarization and a flux detector are needed. No permanent magnets disposed with

respect to the shaft are used in the sensor itself or during torque sensing. This prior art configuration has disadvantages. For example, magnetization of the shaft which is induced in advance of operable sensor construction (such as found in Garshelis), is subject to variations in the manufacturing process and leads to variations in performance among sensor assemblies. Also, the polarization of the shaft is subject to field strength decay over time. As the field decays, the sensor may need recalibration, remagnetization of the shaft or, most likely, replacement of at least the shaft. In certain applications, such as when the shaft is part of a gear box, replacement of the shaft can be undesirable. In addition, testing of the prior art sensors cannot be effectively carried out until the polarized shaft is assembled with the field sensor. This presents an undesirable quality control situation that has potentially wasteful consequences in terms of time and resources.

The sensor as set forth in claim 1 addresses these issues by using permanent magnet poles to induce a field in the shaft, thereby obviating the need for a shaft that has been pre-magnetized. As a result, the manufacturing step to magnetize the shaft can be omitted, leading to more efficient and less costly production and reducing the potential for manufacturing variations from sensor to sensor. Decay of the field strength of the shaft's polarized regions is not an issue since components to induce a field in the shaft are included as an operable part of the sensor.

Turning to Garshelis, Garshelis discloses a shaft with a permanent circumferentially magnetized region and a field sensor (see, for example, column 4, line 66 to column 7, line 12). No field inducing magnets are included.

A method of constructing Garshelis' sensor is described at column 15, line 9 and onward in which it is explained that the magnets illustrated in figure 3 are for the purposes of pre-magnetizing the shaft and do not form part of the operation sensor assembly of Garshelis. That is, once the polarization has been preformed, the shaft is taken away from the magnets of figure 3 and the shaft is used in the sensor.

As should be appreciated, Garshelis does not teach or reasonably suggest the claimed operational sensor that includes "a pair of opposite permanent magnet poles" that "induce a localized magnetic field in the magnetostrictive material ... during torque sensing."

As a result, claim 1 is considered to be patentable. Claims 2-3 and 6-10 depend from claim 1 are also considered to be patentable for at least the same reasons. Independent apparatus claims 11, 13 and 14, and the claims respectively depending therefrom, are considered to be patentable for at least the reasons outlined above with respect to claim 1. Method claims 17 and 18 include applying an external magnetic field to induce a magnetic field in magnetostrictive material of a shaft during a torque sensing operation. Therefore, claims 17 and 18 are considered to be allowable for at least the same reasons.

Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(b) are respectfully requested.

Conclusion

In view of the foregoing, request is made for timely issuance of a notice of allowance.

Respectfully submitted,

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